MULTIMEDIA UNIVERSITY

STUDENT ID NO

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# MULTIMEDIA UNIVERSITY

# FINAL EXAMINATION

**TRIMESTER 2, 2022/2023**

## PMT0201 – MATHEMATICS II

( TC1L & TC2L )

10 JUNE 2023
9.00 a.m. – 11.00 a.m.
( 2 Hours )

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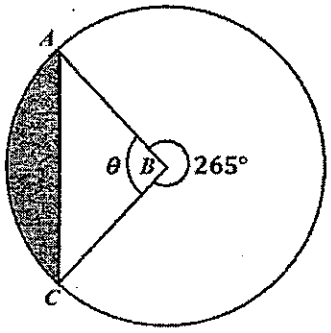
**INSTRUCTIONS TO STUDENT**

1. This question paper consists of **3** pages (**2** pages with **5** questions and **1** page of appendix). Key formulae are given in the Appendix.
2. Answer ALL questions.
3. Please write all your answers in the Answer Booklet provided.
4. All necessary working steps must be shown.

**QUESTION 1** **[10 Marks]**

a) The diagram below shows sector $ABC$ with center $B$. Given that the radius of the circle is 11cm.




i. Find the value of $\theta$, in radian. (1 mark)

ii. Show that the area of the shaded region is $40.04\text{cm}^2$. (2.5 marks)

iii. Find the length of the line $AC$. (2 marks)

b) The trigonometry function, $y = -\cos\left(\frac{x}{2} + \pi\right) + 1$ has been through several transformations from $y = \cos(x)$.

i. Identify the changes in phase shift, period and vertical shift of the function. (1.5 marks)

ii. Sketch clearly both trigonometry functions for one complete period stated above **on the same axes** and label completely. (3 marks)

**QUESTION 2** **[10 Marks]**

a) Evaluate $\csc\left(\cot^{-1}\left(\frac{4}{x}\right)\right)$ and leave your answer in term of $x$. (1.5 marks)

b) Solve $2\cos^2 x + \sin x = 1$ for $0° \leq x \leq 360°$. (3.5 marks)

c) Prove $(-\sin x) = (\cos x + 1)(\cot x - \csc x)$. (2 marks)

d) Given $w = 2(\cos 80° + i \sin 80°)$. Use De Moivre's Theorem to find $w^4$ and express your answer in the rectangular form with two decimal places. (3 marks)

**Continued...**

**QUESTION 3** **[10 Marks]**

a) Evaluate the following limits:

i. $\lim_{x\to 2}\left(\frac{x^2-2x+6}{(2x+1)^2}\right)$ (1.5 marks)

ii. $\lim_{x\to 1}\left(\frac{7x^2-9x+2}{x^2-1}\right)$ (2 marks)

iii. $\lim_{x\to \infty}\left(\frac{3x^3-2x+6}{x^3+2x^2+3}\right)$ (2.5 marks)

b) Given $f(x)=\begin{cases} 2x+8k & if \quad x\geq 0 \\ \sqrt{x+16}+4 & if \quad x<0 \end{cases}$ where $k$ is a constant.

i. Find the value of $\lim_{x\to 0^+} f(x)$. (1 mark)

ii. Find the value of $\lim_{x\to 0^-} f(x)$. (1 mark)

iii. Find the value of $f(x)$. (1 mark)

iv. If the function is continuous at $x=0$, find the value of $k$. (1 mark)

**QUESTION 4** **[10 Marks]**

a) By using the formal definition of derivative, find $f'(x)$ if $f(x)=x^2-1$. (2 marks)

b) Find the derivatives of

i. $y=e^x \ln x$ (2 marks)

ii. $y=\sin(3x+2)$ (3 marks)

c) Given the position function of a particle is $s=2t^3-4t^2+3t$, determine the time when the velocity of the particle is zero. (3 marks)

**QUESTION 5** **[10 Marks]**

a) Find the integral of $\int x^2\sqrt{1+x^3}\,dx$ by using integration by substitution. (3 marks)

b) Use integration by parts to find $\int x \sin x\,dx$. (3 marks)

c) Given the parabolas $y=x^2$ and $y=4x-x^2$. Find the points of intersection between the curves and calculate the area of region enclosed by the two parabolas. (4 marks)

**Continued...**

# APPENDIX

**Trigonometry:**

$$\frac{a}{\sin A}=\frac{b}{\sin B}=\frac{c}{\sin C} \qquad Area=\frac{1}{2}ab(\sin C) \qquad Area=\frac{1}{2}r^2\theta$$

$$\cos^2\theta+\sin^2\theta=1 \qquad \sec^2\theta=1+\tan^2\theta \qquad \csc^2\theta=1+\cot^2\theta$$

**Derivatives:** $f'(x)=\lim_{h\to 0}\frac{f(x+h)-f(x)}{h}$

**Differentiation Rules**

***General Formulae***

1. $\frac{d}{dx}[f(x)g(x)]=f(x)g'(x)+g(x)f'(x)$
2. $\frac{d}{dx}\left[\frac{f(x)}{g(x)}\right]=\frac{g(x)f'(x)-f(x)g'(x)}{[g(x)]^2}$
3. $\frac{d}{dx}(x^n)=nx^{n-1}$
4. $\frac{d}{dx}[f(u)]=\frac{dy}{du}.\frac{du}{dx}$

***Exponential and Logarithmic Functions***

1. $\frac{d}{dx}(e^x)=e^x$
2. $\frac{d}{dx}(a^x)=a^x\ln a$
3. $\frac{d}{dx}(\ln x)=\frac{1}{x}$
4. $\frac{d}{dx}(\log_a x)=\frac{1}{x\ln a}$

***Trigonometric Functions***

1. $\frac{d}{dx}(\sin x)=\cos x$
2. $\frac{d}{dx}(\cos x)=-\sin x$

**Table of Integrals**

1. $\int u\,dv=uv-\int v\,du$
2. $\int u^n\,du=\frac{u^{n+1}}{n+1}+C, \quad n\neq -1$
3. $\int\frac{du}{u}=\ln|u|+C$
4. $\int e^u du=e^u+C$
5. $\int\sin u\,du=-\cos u+C$
6. $\int\cos u\,du=\sin u+C$

**Application of Integrals:**

***Area between curves*** $A=\int_a^b[f(x)-g(x)]\,dx$ $A=\int_c^d[w(y)-v(y)]\,dy$

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